WHAT IS CLAIMED IS:

1. A field device coupleable to a fieldbus process communication loop, the device comprising;

a power module coupleable to the loop to power the device with energy received from the loop;

a fieldbus loop communicator coupleable to the loop, and adapted to bi-directionally communicate over the loop;

a controller coupled to the fieldbus loop communicator;

diagnostic circuitry coupled to the controller and operably coupleable to the loop, the diagnostic circuitry adapted to measure a loop-related parameter; and

wherein the controller provides diagnostic information based upon the loop-related parameter.

2. The field device of claim 1 wherein the fieldbus process communication loop is selected from the group consisting of FOUNDATION™ fieldbus (H1), Profibus™, ControlNet, P-Net, SwiftNet, WorldFIP, Interbus-S, and FOUNDATION™ Fieldbus High-Speed Ethernet (H2).

3. The field device of claim 1 wherein the diagnostic circuitry further comprises an intrinsic safety barrier and wherein the diagnostic circuitry is coupleable directly to the fieldbus process communication loop.

4. The field device of claim 1, wherein the diagnostic circuitry is indirectly coupleable to the fieldbus process communication loop.

5. The device of claim 4, wherein the diagnostic circuitry includes a temperature sensor adapted to provide a signal related to temperature of a fieldbus communication circuit in the field device.

6. The field device of claim 1, wherein the loop-related parameter is instantaneous DC voltage.

7. The device of claim 1, wherein the loop-related parameter is long term variation of the DC voltage.

8. The device of claim 1, wherein the loop-related parameter is instantaneous current drawn by the field device.

9. The device of claim 1, wherein the loop-related parameter is long term variation of current drawn by the field device.

10. The device of claim 1, wherein the loop-related parameter is peak to peak communications signal strength on the process communication loop.

11. The device of claim 1, wherein the loop-related parameter is a lowest signal source on the loop and a device ID and address of the lowest signal source.

12. The device of claim 1, wherein the loop-related parameter is a quiescent noise level on the loop.

13. The device of claim 1, wherein the loop-related parameter is a characteristic impedance of the loop.

14. The device of claim 1, wherein the controller executes a neural network analysis of the loop-related parameter to provide the diagnostic signal.

15. The device of claim 1, wherein the controller executes fuzzy logic upon the loop-related parameter to provide the diagnostic signal.

16. The device of claim 1, wherein the diagnostic circuitry measures a plurality of loop-related parameters, and wherein the controller provides a diagnostic signal based upon a combination of the loop-related parameters.

17. The field device of claim 1 wherein the diagnostic circuitry is adapted to measure a plurality of loop-related parameters and provide failure prediction based upon the plurality of loop-related parameters.

18. The field device of claim 1 wherein the diagnostic information is indicated from the loop communicator to a computerized maintenance management

system (CMMS) for maintenance work orders.

19. The field device of claim 18 wherein the diagnostic information is selected to alert an operator to change control strategies.

20. A method of providing diagnostics on a fieldbus process communication loop, the method comprising:

operably coupling diagnostic circuitry to the fieldbus process communication loop;

measuring a parameter of the loop; and

analyzing the parameter to provide a diagnostic output.

21. The method of claim 20 wherein analyzing the parameter includes performing a neural network analysis on the measured parameter.

22. The method of claim 21, wherein analyzing the parameter further includes performing fuzzy logic upon the measured parameter.

23. The method of claim 20, wherein analyzing the parameter includes performing fuzzy logic upon the measured parameter to provide the diagnostic output.

24. The method of claim 20, wherein operably coupling diagnostic circuitry to the loop includes operably coupling the diagnostic circuitry to the loop via a loop communicator to allow the diagnostic

circuitry to access data communicated by the loop communicator.

25. The method of claim 20 wherein analyzing the parameter to provide a diagnostic output further comprises applying a least squares method analysis to the measured parameter.

26. The method of claim 20 wherein analyzing the parameter to provide a diagnostic output includes applying a neural-network analysis to the measured parameter.

27. The method of claim 20 wherein analyzing the parameter to provide a diagnostic output further comprises applying a fuzzy-logic algorithm to the measured parameter of the loop.